

APPENDIX K

MITIGATION PLAN FOR CONSTRUCTIBLE ELEMENTS

1. INTRODUCTION

A mitigation program (wetland mitigation plan) was developed by the USACE, in coordination with the Habitat Evaluation Team (HET), to compensate for both direct and indirect impacts to wetland habitats associated with the constructible elements of the proposed 1% AEP alternative (the 1% AEP project). These constructible elements (constructible components; constructible features) include project levee reaches F1, F2, and G1, the HNC Lock Complex, and the Bayou Grand Caillou Floodgate. This appendix provides detailed information concerning the proposed mitigation program.

The mitigation program/plan discussed herein was based on conceptual mitigation design plans. At this stage, many important aspects of the proposed mitigation plan have not been determined. For example, the locations and limits of additional borrow sites, if needed, to obtain fill to construct the proposed mitigation features are unknown as are other mitigation construction components such as construction access corridors and staging areas.

Given uncertainties such as those above, several aspects of the mitigation program discussed herein will be refined and modified during the Preconstruction Engineering & Design (PED) phase of the project. USACE will coordinate closely with the HET, the Non-Federal Sponsor (NFS), and other members of the Project Delivery Team (PDT) during the PED phase in making any refinements and modifications to the mitigation program. It is possible that further investigations and analyses conducted during this phase could reveal potential environmental impacts not previously considered or could mandate substantial changes to the mitigation plan. Under such circumstances, it may be determined that a supplemental NEPA document addressing the mitigation plan is warranted. This supplemental NEPA document would be prepared by USACE if necessary, in coordination with the HET, NFS, and PDT.

All figures cited herein are provided at the end of this appendix. Section 10 contains definitions of certain terms used in this appendix. All elevations mentioned herein are expressed in feet NAVD88(2004.65).

2. MITIGATION OBJECTIVES

The primary objective of the proposed mitigation project is to restore approximately 1,509 acres of intermediate marsh habitat, 358 acres of brackish marsh habitat, and 975 acres of saline marsh habitat in order to fully compensate for direct and indirect impacts to fresh marsh, intermediate marsh, brackish marsh, and saline marsh habitats, as well as indirect impacts to open water habitats, that would result from building the constructible elements of the 1% AEP alternative. The proposed marsh restoration features are shown in Figures K1 through K4.

Wetland Value Assessment (WVA) models (refer to Appendix F) were run for the cited impacts to determine the wetland functions and values that would be lost. Such functions/values are expressed in terms of Average Annual Habitat Units (AAHUs). As indicated in Table K-1 below, these models predicted that approximately 434.47 AAHUs would be lost due to direct and indirect impacts to existing fresh and intermediate marsh habitats combined, while approximately 534.07 AAHUs would be lost due to direct and indirect impacts to existing brackish and saline marsh habitats combined, over the course of the 50-year period of analysis.

Table K-1. Project wetland (habitat) impacts for constructible elements of the project.

Habitat	Direct Impacts		Indirect Impacts		Total Impacts	
	Acres	AAHUs	Acres*	AAHUs	Acres	AAHUs
Fresh Marsh	26	12.74	3,965	39.73	3,991	52.47
Intermediate Marsh	230	28.04	16,020	353.96	16,250	382.00
Total Fresh Marsh & Intermediate Marsh	256	40.78	19,985	393.69	20,241	434.47
Brackish Marsh	414	350.98	12,442	41.33	12,856	392.31
Saline Marsh	0	0	13,788	141.76	13,788	141.76
Total Brackish Marsh & Saline Marsh	414	350.98	26,230	183.09	26,644	534.07
GRAND TOTALS	671	391.76	46,215	576.78	46,886	968.54

Note: The AAHUs indicated are the net loss of AAHUs resulting from the project impacts, and thus should be viewed as negative values.

* The acres of indirect impacts to a particular marsh habitat type include the total acres of that type of marsh impacted, together with the total acres of open water habitats having the same salinity regime as the type of marsh impacted. For example, the table indicates 16,250 acres of intermediate marsh affected by indirect impacts. This acreage is not to intermediate marsh alone; instead it includes the acres of intermediate marsh impacted together with the acres of open water habitats having the same salinity range as intermediate marsh habitats.

CEMVN Regulatory Division considers fresh marsh and intermediate marsh habitats to essentially be equivalent habitat types. CEMVN Regulatory Division also considers brackish marsh and saline marsh habitats to essentially be equivalent habitat types. In accordance with these policies, mitigation for impacts to fresh marsh habitats can take the form of restoration of intermediate marsh habitats and vice versa to meet the requirement of "in-kind" mitigation. Similarly, mitigation for impacts to brackish marsh habitats can take the form of restoration of saline marsh habitats and vice versa. These policies have also been approved by the HET on a case by case basis.

The proposed mitigation plan was based on the policies mentioned above as regards achieving in-kind mitigation for project impacts. In other words, compensation for impacts to fresh marsh and intermediate marsh habitats is achieved through the restoration of intermediate marshes while compensation for impacts to brackish marsh and saline marsh habitats is achieved through restoration of both brackish marsh and saline marsh habitats.

WVA models on a generic site in the general project area were run to produce a mitigation potential number by habitat type (e.g. models predicted the average net gain in AAHUs that would be produced by restoring the various marsh habitat types; mitigation potential = net gain in AAHUs/acre of marsh restoration). These model results were then used to determine the needed acres of mitigation. Individual WVA models will be run on the proposed mitigation features during the PED phase to verify that the proposed mitigation features can indeed produce the required AAHUs, and the proposed mitigation features will be adjusted as necessary to yield the required AAHUs.

Table K-2 lists each of the four intermediate marsh features proposed, the acreage of each feature, and the speculated net gain in AAHUs (e.g. net gain in wetland functions/values) that would be derived from each feature over the course of the 50-year period of analysis. Table K-3 provides similar data for each of the three brackish marsh features proposed and for each of the three saline marsh features proposed.

Table K-2. Proposed mitigation for fresh marsh and intermediate marsh impacts.

Mitigation Feature ID	Proposed Habitat	Acres	Net Gain AAHUs
IM1	Intermediate Marsh	869	251.14
IM2	Intermediate Marsh	293	84.68
IM3	Intermediate Marsh	213	61.56
IM4	Intermediate Marsh	134	38.73
Totals		1,509	436.10

Table K-3. Proposed mitigation for brackish marsh and saline marsh impacts.

Mitigation Feature ID	Proposed Habitat	Acres	Net Gain AAHUs
BM1	Brackish Marsh	129	58.05
BM2	Brackish Marsh	170	76.5
BM3	Brackish Marsh	59	26.55
Total Brackish Marsh		358	161.10
SM1	Saline Marsh	241	92.30
SM2	Saline Marsh	342	130.99
SM3	Saline Marsh	392	150.14
Total Saline Marsh		975	373.43
GRAND TOTALS		1,333	534.53

The initial WVA models indicate that the total net gain in AAHUs derived from the proposed intermediate marsh restoration features will be 436.10 AAHUs, while the total net loss of AAHUs resulting from impacts to both fresh marsh and intermediate marsh habitats combined would be 434.47 AAHUs. This demonstrates that the proposed intermediate marsh restoration should fully compensate for the fresh marsh and intermediate marsh functions/values lost due to the constructible project elements.

The initial WVA models indicate that the total net gain in AAHUs derived from the proposed brackish marsh and saline marsh restoration features combined will be 534.53 AAHUs, while the total net loss of AAHUs resulting from impacts to both brackish marsh and saline marsh habitats combined would be 534.07 AAHUs. This demonstrates that the proposed brackish and saline marsh restoration should fully compensate for the brackish marsh and saline marsh functions/values lost due to the constructible project elements.

One of the secondary objectives of the proposed mitigation project is to eradicate invasive and nuisance plant species within the mitigation features and to control re-infestation of the mitigation features by such plants. Invasive/nuisance plant species have the potential for jeopardizing the growth and development of native marsh species, thereby reducing typical functions and values associated with marsh habitats. The eradication and control of invasive/nuisance plant species will help ensure the restored marshes provide habitat and habitat functions/values typical of such marshes.

3. MITIGATION WORK PLAN

The proposed mitigation work plan consists of three primary components. These include the construction of the proposed marsh restoration features (refer to Figures K-1 through K-4), planting of the marsh restoration features, and eradication of invasive and nuisance plant species in the marsh restoration features.

3.1 CONSTRUCTION OF MARSH RESTORATION FEATURES

Earthen containment dikes (retention dikes) would first be constructed along the outer perimeter of each marsh feature to contain earthen materials (typically a slurry of sediments and water) placed within the marsh feature until these materials have consolidated and settled to desired final target grade elevation.

The earthen retention dikes would be built to an elevation that allows storage of both the borrow material and water needed to transport the material. In addition, the crest of the dikes would include a minimum one foot of freeboard to prevent overflow of effluent over the freshly constructed earthen dikes. Effluent discharge points (effluent returns, constructed as spill boxes or weirs) would be established at one or more locations along the course of the retention dikes at the time of construction to allow for effluent water release from within the mitigation feature. The freeboard of the dikes would act as a training dike to direct effluent waters over the effluent return locations. These locations would be determined during the PED phase. If practicable, the effluent returns would be positioned such that the effluent would flow into existing adjacent marsh habitats and thereby help nourish the adjacent marshes.

The earthen retention dikes would have a crown (top or crest) width of 5 feet and would have 1V:3H (Vertical:Horizontal) or 1V:4H side slopes depending on characteristics of the material used to construct the dikes. Borrow necessary to construct the retention dikes would be obtained from within the boundaries of the mitigation feature being established. The borrow ditch would be offset a minimum of 40 feet from the interior toe of the dike to ensure dike stability. If deemed necessary by the construction contractor, low level interior weirs could be constructed within a particular mitigation feature to assist in vertical stacking of the material used to establish the feature platform. During the PED phase, it may be determined that one or more retention (containment) dike segments may need to be constructed as armored earthen dikes or as rock dikes. The specific dimensions and characteristics of such dike segments would be specified in the PED phase.

Once construction of the containment dikes is completed, fill (borrow material) would be placed within the containment dikes to establish the marsh platform. Initial fill elevations (initial target grade elevations) within the features would be higher than the proposed final target grade elevations (desired final grades) due to expected dewatering and foundation settlement. Settlement curves based on onsite geotechnical data would be developed during the PED phase to finalize the amount of overbuild needed. Generally speaking, the initial target grade elevations would likely range from roughly 2 feet to 2.5 feet above the final target grade elevations.

The final target grade elevations desired within each proposed marsh feature would be determined during the PED phase. This determination would be based on bio-benchmark surveys of existing healthy marsh habitats in the general vicinity of the proposed marsh features. The protocol used in these surveys would be to determine the average elevation of at least 3 healthy marsh locations near each of the three groups of mitigation features (e.g. the intermediate marsh restoration feature group, the brackish marsh restoration feature group, and the saline marsh restoration feature group). The marsh surface elevation would be based on when the survey rod is resting among living stems or is supported by soil containing living roots. In order to get a consistent reading, it might be necessary to cut vegetation stems where stem density is extremely high. A minimum of approximately 20 elevations (each separated by roughly 20 to 40 feet) at each of the representative healthy marsh sites would be collected during the survey efforts.

Preliminary estimates of the desired final target elevations in the proposed marsh restoration features are as follows: Intermediate marsh features IM1 through IM4 = elevation 1.0; Brackish marsh features BM1 through BM3 = elevation 1.0 to 1.5; Saline marsh features SM1 through SM3 = elevation 1.5 or slightly higher. It is emphasized that these are preliminary estimates based on examination of existing LiDAR topography covering existing marshes near the proposed marsh features.

It is anticipated that it would take approximately 9 to 12 months to complete construction of the containment dikes and placement of fill in the marsh restoration features, although it could take longer depending on the availability of construction contractors. It is estimated that it would take an additional 9 to 12 months for the fill placed in the marsh restoration features to settle to the desired final target grade elevations. Once the fill

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has settled to the final target grade, the containment dikes would, to the extent practicable, be mechanically degraded such that the elevation of the degraded dike crest is the same as the elevation of the marsh feature. However, it may be necessary to create “gaps” in these dikes rather than completely degrading them. It is also possible that some dikes may be designed as armored earthen dikes or as rock dikes to help protect created marsh features. In such cases, leaving the dike crest elevation higher than the marsh platform elevation would be desirable and provision of dike gaps or “fish dips” in the dike would be necessary. General design criteria for dike gapping would include:

- If total dike degradation is not feasible, one 25-foot gap (bottom width) approximately every 500 linear feet of dike would be provided. The depth of a gap would be dependent upon whether the marsh is bordered by open water or existing marsh. Gaps adjacent to open water would have a depth equivalent to the pre-project water depth. Gaps adjacent to pre-existing marsh would have a depth equivalent to the average marsh elevation.
- If scour aprons are included, the bottom would be grubbed out so the gap depth is the pre-project elevation as measured to the top of the armoring.
- Degraded containment dike material would typically be placed either in remaining depressions within the marsh mitigation feature formed by excavation when building the dikes, or immediately adjacent to exterior side of the dike in open water areas. Degraded material would not be placed in pre-existing marshes.
- Field adjustments in the typical spacing and dimensions of gaps would be allowed based on conditions developing in the marsh restoration feature; however, such adjustments would only be made in coordination with NMFS and the rest of the HET and as approved by NMFS.

The proposed marsh restoration features could potentially block water exchange between adjacent existing marsh habitats and waterbodies, and could also reduce the ability of aquatic organisms to access these marsh habitats. To help reduce such effects, trenasses (tidal creeks, shallow flowways/channels) would be constructed through certain marsh restoration features.

These primary trenasses would be constructed in conjunction with the degrading of the retention dikes. The trenasses would have a bottom width of approximately 25 feet and a bottom elevation of approximately 1 foot deep in relation to the final target marsh grade. In addition to the primary trenasses, additional smaller trenasses would be constructed within proposed marsh features to serve as tidal creeks to facilitate water exchange and create shallow water interspersed features. In conjunction with the dike degrading efforts, these smaller trenasses would be rutted to a lower- than-marsh elevation by performing two passes of a marsh buggy along the desired alignment. The acceptable trenasse width, if constructed in this fashion, would be the width of the marsh buggy. If the resulting depression is not adequate for minimal water flow, the marsh equipment could excavate material along the proposed alignment, not to exceed a 5-foot bottom width by 1-foot to 1.5-foot deep channel. The locations, alignments, and dimensions of all trenasses would be determined during the PED phase.

Once the fill placed in the marsh restoration features has settled to the final target grade, each marsh feature would be planted with native marsh plant species as soon as feasible. Section 3.2 provides information concerning proposed marsh plantings.

One should also note that Figures K-1 through K-4 do not illustrate potential borrow sites that may be needed to build the marsh restoration features. The USACE proposes to use organic overburden acquired within the levee borrow right-of-way (limited to the right-of-way encompassing the constructible project elements), the lock complex foot print, and the bypass channel as some of the fill needed to establish the marsh platforms. However, it is unknown if this overburden will be insufficient to completely build all the marsh features. Additional borrow material would be obtained from other areas; most likely from dredging existing open water areas. Such borrow areas (borrow sites) would be located to avoid and minimize wetland and shoreline impacts to the extent practicable, as would be other areas needed for mitigation construction such as access corridors and staging areas. Any unavoidable wetland impacts would be fully compensated as part of the proposed mitigation plan.

Borrow sites in open water areas would be excavated via hydraulic dredging, typically using a cutter-head dredge. The maximum depth of dredging would typically be limited to 15 to 20 feet below the existing water bottom. If portions of the existing Houma Navigation Canal are dredged for borrow, the depth of dredging

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would be limited to the depth previously authorized for maintenance dredging. Borrow acquired via dredging would typically be transported to the proposed marsh features via hydraulic pump and pipelines that would carry the slurry to the features. In certain cases, the dredged material would be transported to marsh features via barge and mechanically placed in the marsh feature.

The pipelines used to carry material from the borrow sites to the marsh restoration features could be routed: as submerged pipelines (laid along existing water bottoms; trenching used where needed to not impede navigation or recreational uses); as pontoon lines (pipelines suspended near surface of water by pontoons, with safety marker signs installed every 150 linear feet of pipeline); by running pipelines along existing shoreline/canal bank; using a combination of these approaches.

Flotation access corridors (channels) would be excavated as needed in shallow open water areas to allow construction equipment to access the mitigation features and borrow sites. If necessary, flotation access channels would be excavated by a mechanical dredge to maximum dimensions of approximately 80 feet wide and 10 feet deep. Flotation access channel material would be used in dike/closure construction or refurbishment, to backfill flotation access channels, or be placed adjacent to and behind the containment dikes and closures in shallow open water to an elevation conducive to wetlands development following consolidation of the material. Flotation access channel material used to backfill the flotation access channels following completion of disposal work would be temporarily stockpiled on water bottoms adjacent to the flotation access channels.

Access corridors to marsh restoration features and borrow sites would be a maximum of about 200 feet wide and would cross over uplands, wetlands, and shallow open water as necessary. Access corridors also may be placed across or along the crown of existing levees in the project vicinity. If existing canals are used for access, they may be dredged to facilitate the flotation of pipelines and the transport of other necessary equipment to material discharge sites. Material removed from existing canals would be placed on adjacent levees and/or into shallow open water on either side of canals. Canal dredged material placed in shallow open water areas would be placed at a height conducive for wetlands development.

If construction equipment and discharge pipelines are placed across or along the crown of existing levees in the project vicinity, the levees may be refurbished using borrow material from adjacent shallow open water to facilitate their use as access corridors for construction equipment and discharge pipelines. Access corridors crossing existing levees would be no wider than about 100 feet.

Existing levees near the proposed marsh features may be degraded as necessary to provide mitigation construction access. Levees degraded for construction access may be rebuilt following completion of disposal activities. Degraded levee material would be placed/stockpiled in shallow open water adjacent to the degraded levee sections or on adjacent levees. Material degraded from levees may be used to rebuild degraded levee sections. Borrow material required to rebuild degraded levee sections would be excavated from adjacent shallow water. If levees are not to be rebuilt using material removed during levee degradation activities, any levee material that was placed in shallow open water would be degraded, if necessary, to a height conducive to wetlands development.

The construction or designation of staging areas may be necessary for mitigation construction equipment and for the unloading of pipeline and other equipment necessary to perform disposal operations. Staging areas would have a maximum area of about 300 feet by 300 feet. If necessary, materials such as gravel, sand, dirt, shell, or some combination of earthen materials would be permanently placed over existing upland, wetland, and shallow open water habitat to construct staging areas.

Temporary board roads may be constructed along access corridor alignments and staging areas wherever emergent marsh exists. Board roads would be removed when work is completed. Fill material may be deposited where the board road would be located to offset damage to the underlying marsh caused by soil compression. Board road fill material may be degraded to adjacent marsh elevations following completion of disposal activities either by placing excess material into nearby shallow open water to elevations conducive to wetlands development, by placing material on existing uplands/levees, or by removing material from the project vicinity.

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Details of borrow sites, construction access corridors, flotation access corridors, levee access corridors, and construction staging areas will be developed during the PED phase. Every effort would be made to design these work plan components so as to avoid and minimize environmental impacts to the extent practicable. Any unavoidable impacts to wetland habitats would be mitigated through the expansion of one or more of the proposed marsh restoration features, depending on the type of habitat affected.

The USACE will be responsible for conducting all the mitigation construction activities, although the costs associated with these activities will be cost-shared with the NFS.

The construction activities listed in this section would be implemented concurrent with the construction of the constructible project elements (constructible elements of the 1% AEP alternative). To the extent practicable, the initial mitigation construction activities would be completed within 18 months of the start of mitigation construction. These initial mitigation construction activities would include construction of the containment/retention dikes and the initial placement of all fill (borrow) material necessary to establish the marsh restoration features. The initial construction activities (initial construction phase) would not include the time period necessary for the borrow material to settle to the final target marsh platform elevation and would not include subsequent construction activities, such as degrading or gapping the containment dikes, or completion of initial plantings.

3.2 INITIAL PLANTING OF MITIGATION FEATURES

Herbaceous species will be planted on 7-foot centers (average) to achieve a minimum density of 889 plants per acre. Stock will typically be either 4-inch container size or bare-root or liner stock, depending on the species involved. Plants will be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. The plants will typically be installed during the period from March 15 through June 15. Planting should not be undertaken later than approximately July 15, although planting during the early fall may be deemed acceptable on a case-by-case basis if necessary. The plants will be installed in a manner that avoids monotypic rows of the same species (goal is to have spatial diversity and mixture of planted species).

It may be determined that the initial planting of brackish and/or saline marsh features would best be conducted in phases. Using this approach, a certain percentage of the total number of plants required would be installed in the year that final marsh construction activities are completed while the remainder would be installed in the following year. The determination of whether to use phased planting or to install all the necessary plants upon completion of construction activities will be made during the PED phase.

Species installed in proposed intermediate marsh habitats will be selected from the species list provided in Table K-4. Plantings will consist of at least 2 different species. Species installed in proposed brackish marsh habitats will be selected from the species list provided in Table K-5. Plantings will consist of at least 2 different species. Species installed in proposed saline marsh habitats will be selected from the species list provided in Table K-6. Plantings will consist of at least 2 different species. The species used and the proportion of the total plantings represented by each species will be determined during the PED phase. Various factors such as site conditions and planting stock availability could alter the plant species proposed by the time a contract is awarded for these plantings. Any deviations from the final planting lists determined in the PED phase would have to first be approved by the USACE in coordination with the HET and NFS.

Table K-4: Preliminary Planting List for Intermediate Marsh Habitats

Common Name	Scientific Name
California bulrush	<i>Schoenoplectus californicus</i>
Black needle rush	<i>Juncus roemerianus</i>
Giant cutgrass	<i>Zizaniopsis miliacea</i>
Marsh-hay cordgrass	<i>Spartina patens</i>
Maidencane	<i>Panicum hemitomon</i>
Common threesquare	<i>Schoenoplectus americanus</i>
Big cordgrass	<i>Spartina cynosuroides</i>
Seashore paspalum	<i>Paspalum vaginatum</i>

Table K-5: Preliminary Planting List for Brackish Marsh Habitats

Common Name	Scientific Name
Marsh-hay cordgrass	<i>Spartina patens</i>
Black needle rush	<i>Juncus roemerianus</i>
Smooth cordgrass	<i>Spartina alterniflora</i> var. <i>Vermilion</i>
Saltmarsh bulrush	<i>Schoenoplectus robustus</i>
Common threesquare	<i>Schoenoplectus americanus</i>
Salt grass	<i>Distichlis spicata</i>

Table K-6: Preliminary Planting List for Saline Marsh Habitats

Common Name	Scientific Name
Smooth cordgrass	<i>Spartina alterniflora</i> var. <i>Vermilion</i>
Salt grass	<i>Distichlis spicata</i>
Marsh-hay cordgrass	<i>Spartina patens</i>
Gulf cordgrass	<i>Spartina spartinae</i>
Saltwort	<i>Batis maritima</i>

Also during the PED phase, it may be determined that planting of black mangroves (*Avicennia germinans*) in certain portions of the proposed saline marsh restoration features is desirable. Such plantings would be limited to relatively narrow bands/swaths in the marshes along or near the marsh “shorelines” (e.g. perimeter marsh areas bordering open water areas). Typically such plantings would use 1-gallon stock installed on 7-foot centers, but this generalization could be revised during the PED phase if black mangroves are indeed added to the planting list for certain saline marsh areas.

The initial planting of the mitigation features will be the responsibility of the USACE. Costs associated with this initial planting will be cost-shared with the NFS.

One should note that it was assumed that one re-planting event would be necessary to meet native vegetation success criterion 3.B (refer to Section 7). It was assumed that roughly 50% of the total number of plants initially installed would have to be re-planted to meet this criterion. This re-planting event, which is considered a maintenance action, would be the responsibility of the USACE although the costs associated with this re-planting would be cost-shared with the NFS. Keep in mind, however, this particular re-planting event would be performed if the cited success criterion is satisfied.

3.3 ERADICATION OF INVASIVE AND NUISANCE PLANT SPECIES

Shortly before starting the initial plantings discussed in Section 3.2, invasive and nuisance plant species would be eradicated throughout each of the marsh restoration features. Such plants would be eradicated using ground-based applications of appropriate herbicides as discussed in Section 4. Invasive and nuisance plant eradication events (follow-up events) would take place at various intervals following completion of the initial installation of native plants in each marsh restoration feature as warranted. A preliminary schedule for these “follow-up” events will be developed in the PED phase. However, this schedule could be altered based on the results of mitigation monitoring activities.

The USACE will be responsible for conducting the invasive and nuisance plant eradication events until such time that the following mitigation success criteria are achieved (refer to Section 7): General construction criteria 1.A and 1.B; Topography criteria 2.A and 2.B; Native vegetation criteria 3.A and 3.B; Invasive & nuisance vegetation criterion 4.A. Costs associated with these events (e.g. those that are the responsibility of USACE) will be cost-shared with the NFS.

4. MAINTENANCE AND MANAGEMENT PLAN

One of the maintenance and management activities anticipated involves the short-term and long-term eradication and control of invasive and nuisance plant species. It is anticipated that there will be 1 invasive/nuisance plant eradication event during the year final mitigation construction activities are completed, 2 such events during the year the mitigation features are first planted, and at least 2 such events during each of the three years following the year of initial planting. It is anticipated that there will be at least 1 invasive/nuisance plant eradication event per year in the fourth and fifth year following the year of initial planting. Thereafter, it is anticipated that there will be one invasive/nuisance plant eradication event every three to five years.

One should note that the actual frequency of invasive/nuisance plant eradication events may differ from the frequency discussed above. The frequency and intensity of these events will largely be determined based on the degree of invasive/nuisance plant infestation observed during mitigation monitoring activities, as well as that observed during periodic inspections of the mitigation features conducted outside the framework of prescribed mitigation monitoring events.

The methods used to eradicate invasive and nuisance plant species may vary. Invasive/nuisance plants will likely be eradicated using ground-based applications of appropriate herbicides to the target plants. The specific equipment (e.g. backpack sprayers, wick applicators, hand application, etc.) used to apply the herbicides will be determined by the contractor to maximize effectiveness. Regardless of the methods involved, care will be exercised to avoid damage to desirable native species to the greatest extent practicable. Ground-based herbicide applications will typically occur during the early part of the growing season in cases where there will be 1 or 2 application events during a given year, and will typically occur again during the latter part of the growing season in cases where there will be 2 application events during a given year.

The USACE will be responsible for performing invasive/nuisance plant eradication events until mitigation success criteria 1.A, 1.B, 2.A, 3.A, 3.B, and 4.A and are all satisfied (refer to Section 7). During this period of responsibility, the USACE will also be responsible for ensuring mitigation success criterion 4.B. is satisfied (refer to Section 7). The cost of performing the activities conducted as the responsibility of the USACE will be cost-shared with the NFS. The NFS will be responsible for performing invasive/nuisance plant eradication events once the cited success criteria are satisfied. The costs for performing these events will be borne solely by the NFS.

As mentioned in Section 4, maintenance/management activities will include one re-planting event conducted after the initial planting of native canopy and midstory species. It was assumed that this event, involving the re-planting of approximately 50% of the total number of plants first installed, would be necessary to satisfy native vegetation success criterion 3.B (see Section 7). However if the referenced success criterion is satisfied, this re-planting event will not be performed. It is not anticipated that subsequent re-plantings will be necessary, with the potential exception of re-planting required for adaptive management (see Section 5). Should additional re-plantings be necessary to satisfy applicable mitigation success criteria, then these re-plantings would become part of the management/maintenance activities.

The USACE will be responsible for performing the single re-planting event discussed above, including provision of the necessary plants, and the cost of this re-planting will be cost-shared with the NFS. The NFS will be responsible for any subsequent re-plantings required to meet applicable mitigation success criteria and the cost for such re-plantings will be borne solely by the NFS, with the exception of re-plantings covered under the Adaptive Management Plan. Re-plantings covered under this plan would be cost-shared with the NFS.

As previously discussed, certain containment dikes along the perimeter of one or more marsh features may be built as armored earthen dikes or as rock dikes. Should this be the case, maintenance activities would likely include periodic repair and/or rehabilitation of such dike segments, including dike gaps and fish-dips, to ensure their integrity and help prevent erosion/loss of adjacent restored marsh habitats. It is assumed that at least one maintenance event would be necessary during the period of mitigation monitoring. However, additional maintenance events may be necessary to help ensure applicable mitigation success criteria are

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achieved. The NFS would be responsible for conducting all maintenance activities and the cost of the single maintenance event anticipated would be borne solely by the NFS. Any dike maintenance activities conducted pursuant to the Adaptive Management Plan would be cost-shared with the NFS.

5. ADAPTIVE MANAGEMENT PLAN

Adaptive Management (AM) activities during the life-cycle of the mitigation project will address ecological and other uncertainties that could prevent successful implementation of the mitigation features as described within this appendix. AM also establishes a framework for decision making that utilizes monitoring results and other information, as it becomes available, to update project knowledge and adjust management/mitigation actions. Hence, early implementation of AM and monitoring allows for a project that can succeed under a wide range of conditions and can be adjusted as necessary. Furthermore, careful monitoring of project outcomes both advances scientific understanding and helps adjust the project as part of an iterative learning process. This AM plan allows for taking corrective actions in cases where monitoring demonstrates that mitigation measures are not achieving ecological success.

WRDA 2007, Section 2036(a) requires an AM plan for all mitigation plans and specifies:

- an AM plan will be developed for all mitigation plans.
- the AM plan must be appropriately scoped to project scale;
- if the need for a specified adjustment is anticipated due to high uncertainty the nature and costs for actions should be explicitly described as part of the decision document;
- the information provided by the monitoring plan will be used by the District Engineer and Division Commander to guide decisions on operational and or structural changes that may be needed to insure the mitigation measures meet success criteria;
- identified physical modifications will be cost-shared and must be agreed upon by the local non-Federal sponsor;
- adaptive management plan costs should be shown in 06 feature code of the cost estimate;
- changes to the AM plan approved in the decision document must be coordinated with USACE Headquarters; and
- significant changes needed to achieve ecological success that cannot be addressed through operational changes or are not included in the approved AM plan may be examined under other authorities.

Independent of AM, an effective monitoring program is required to determine if the mitigation project outcomes are consistent with performance standards. Mitigation success criteria were developed as the basis of determining ecological success and to determine if adaptive management actions are required. Upon completion of the mitigation project, monitoring for ecological success will be initiated and will continue until ecological success is achieved, as defined by the mitigation success criteria. The following objectives: performance measures, and adaptive management triggers would be further refined during the PED phase.

Objective 1: Mitigate for project-induced impacts by creating 2,842 acres of intermediate, brackish and saline marsh.

Performance Measure: Marsh elevation (topography).

Threshold/Trigger: If the marsh elevations described in the success criteria/desired outcomes are not maintained, supplemental topographic alterations through adaptive management may be necessary. Additional thresholds/triggers will be developed during PED.

Performance Measure 2: Species composition and percent cover for vegetation plantings.

Threshold/Trigger: If the identified success criteria are not met there may be a need for an adaptive management actions including replanting of areas that no longer meet success criteria and/or replanting of areas that required topographic alterations. Additional thresholds/triggers will be developed during PED.

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Objective 3: Control of invasive and nuisance plant species.

Desired Outcome: Maintain all marsh restoration features such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event. The total average vegetative cover accounted for by invasive and nuisance plant species are each less than 5% of the total plant cover in each marsh feature throughout the duration of the monitoring period.

Threshold/Trigger: No adaptive management is expected to be needed as maintenance of invasive species is part of the O&M for the project. If a large amount of invasive species are removed through O&M efforts, potential AM actions include replanting of the areas previously covered by invasive species. Additional thresholds/triggers will be developed during PED.

The USACE and the NFS will be responsible for any adaptive management determined to be needed to attain the identified success criteria until such time as ecological success is determined and the mitigation project is turned over to the non-Federal Sponsor. In the event the monitoring reports submitted to CEMVN reveal that any success criteria have not been met after the project is turned over and in the OMRR&R phase, the NFS, or its assigns after consultation with CEMVN and other appropriate agencies, will take all necessary measures to modify management practices in order to achieve these criteria in the future.

To better ensure successful performance of the implementation of identified mitigation features the following future scenarios for mitigation features were considered based on critical uncertainties (e.g., salinities, wetland hydrology, inundation, increased subsidence, reduced accretion, tidal amplitude, and Relative Sea Level Rise, etc. The most likely AM action involves wetland renourishment of areas (add additional sediment) or replanting should project monitoring reports indicate success criteria are not being achieved and adjustment of mitigation feature(s) is needed. The following best case, worst case and most likely scenarios are not AM triggers; rather, they were developed to estimate overall AM costs for mitigation projects based upon the potential resiliency of the constructed mitigation projects to the above described uncertainties related to marsh degradation or loss:

- Best Case – Assume 3% loss of 2,842 acres or 85 acres. Replace 85 acres at \$30,000/acre for \$2,550,000
- Worst Case – assume 12% loss of 2,842 acres or 341 acres. Replace 341 acres at \$30,000/acre for \$10,230,000
- Most Likely – Assume approximately 6% loss of 2,842 acres or 171 acres. Replace 171 acres at \$30,000/acre for \$5,130,000

Based upon the above comparison, the most likely scenario (i.e. a total of \$5,130,000) would be allocated for AM actions including potential wetland creation, restoration and renourishment actions over the cost-shared portion of the mitigation projects. Additional costs for AM include data management (\$364,000) and AM Program Planning and Management (\$250,000) for a total Adaptive Management cost of \$5,744,000.

It should be noted that many factors such as ecosystem dynamics, engineering design, institutional requirements, and many other key uncertainties can change and/or evolve over a project's life. The adaptive management and monitoring elements will be updated to reflect monitoring-acquired and other new information, as well as enabling continued resolution of and progress on resolving existing key uncertainties or identification of any new uncertainties that might emerge. The AM plan will be used during and after project construction to adjust the mitigation project, as necessary, to better achieve mitigation success criteria outputs/results.

6. LAND ACQUISITION & PRESERVATION/PROTECTION OF MITIGATION FEATURES

Various lands must be acquired for the proposed mitigation features themselves, for areas required for mitigation construction access, for areas required for borrow sites, and for future mitigation maintenance/management access. Such lands (properties) will be acquired by the Non-Federal Sponsor. Presently the exact locations and types of lands to be acquired have not been identified for all the lands needed. This will be determined during the PED phase.

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Properties required could be privately owned or owned by a governmental agency. For areas that are owned by a governmental agency, the Non-Federal Sponsor will sign an inter-agency agreement that will allow the USACE to construct the mitigation features. Areas that are privately owned will be acquired in accordance with the requirements of Public Law 91-646. Each property to be acquired will be appraised and the owner will be offered the market value of his/her property. The owner will be given an opportunity to negotiate the sale price of the property. If the Non-Federal Sponsor and the owner are not able to come to an amicable agreement as to price or if the title of the property is not clear, the acquisition will be completed through the expropriation process.

In order to accomplish the integrity of the mitigation project, the Non-Federal sponsor will acquire fee excluding minerals over the identified marsh restoration features. This estate allows the owner to retain the mineral rights, but prohibits the use of the surface for exploration or development of the minerals. Depending on the size of the ownership and the size of the mitigation feature to be acquired, the owner may be able to explore and develop minerals through directional drilling. In the development of the appraisal, the appraiser will consider the impact of the acquisition on the remaining property. In some instances, mineral rights may need to be subordinated. Until the final boundaries of the proposed marsh restoration features are identified and ownership search is conducted, this cannot be determined.

Access routes to the marsh restoration features as well as areas for equipment/contractor staging will be acquired by the Non-Federal Sponsor as temporary work area easements. The same could be true for certain borrow sites. Such easements allow the Government the exclusive use of the property for a specified duration of time. These areas would also be appraised and the owner would negotiate with the Non-Federal sponsor the sale price of these temporary acquisitions.

All real estate acquisitions will be accomplished in the name of the Non-Federal Sponsor. The Sponsor in turn will grant the USACE right of entry to accomplish the work. The marsh restoration features will remain in the ownership of the Sponsor who will be responsible for operation and maintenance. Ownership of the sites acquired for temporary use will revert to the landowner upon expiration of the easement.

The Non-Federal Sponsor will be required to preserve and protect the marsh restoration features in perpetuity. This requirement will be assured via the existing Project Partnership Agreement (PPA) between the USACE and the Non-Federal Sponsor, as well as through appropriate language in the Operation and Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) manual that will be prepared for this project by CEMVN and provided to the Non-Federal Sponsor.

7. MITIGATION SUCCESS CRITERIA

The ecological success (performance) criteria applicable to the proposed mitigation are described in the sub-sections that follow. The year numbers cited are based on the initiation of mitigation construction activities beginning in year 1.

1. General Construction

- A. Within approximately 9 to 12 months following the start of mitigation construction, complete all initial mitigation construction activities (e.g. construction of perimeter retention/containment dikes, placement of fill (borrow material/dredged material) into mitigation feature, construction of perimeter rock dikes and/or armoring of perimeter containment dikes if applicable, etc.).
- B. Approximately 1 year following completion of all initial mitigation construction activities (when the restored marsh feature has attained the desired final target soil surface elevation) complete all final mitigation construction activities. Such activities could include, but are not limited to: degrading perimeter containment dikes such that the areas occupied by these dikes have a surface elevation equivalent to the desired final target marsh elevation; completion of armoring, if required, of any containment dikes; "gapping" of perimeter containment dikes and/or installation of "fish dips" in perimeter containment dikes, if necessary; and construction of trenasses or similar features within marsh features as a means of establishing shallow water interspersed areas within the marsh. Finishing the aforementioned

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construction components will be considered as the “completion of final mitigation construction activities”. As noted, this is anticipated to occur approximately 1 year after placement of fill material in the mitigation feature is completed.

2. Topography

- A. Upon completion of final mitigation construction activities (near end of Year 2) –
 - Demonstrate that at least 80% of each mitigation feature has a surface elevation that is within 0.5 feet of the desired final target surface elevation.
- B. 1 year following completion of final mitigation construction activities (Year 3) –
 - Demonstrate that at least 80% of the mitigation site has a surface elevation that is within 0.5 feet of the desired final target surface elevation.
- C. 3 years following completion of final mitigation construction activities (Year 5) –
 - Demonstrate that at least 90% of the mitigation site has a surface elevation that is within the functional marsh elevation range.

Notes: The desired final target elevation for each marsh feature would be determined during the final PED phase. The “functional marsh elevation range”, e.g. the range of the marsh surface elevation that is considered adequate to achieve proper marsh functions and values, would also be determined during the PED phase. These determinations will apply to the topographic success criteria above and could potentially alter the marsh area percentages set forth in these criteria.

3. Native Vegetation

- A. Complete initial plantings in each marsh feature in accordance with the applicable marsh planting specifications (early in Year 3).
- B. 1 year following completion of initial plantings (Year 4) –
 - Within each marsh feature, attain at least 80% survival of planted species, or; Achieve a minimum average cover of 50%, comprised of native herbaceous species (includes planted species and volunteer species). As regards survival of planted species, the surviving plants must approximate the species composition and the species percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement. Note that if black mangroves were installed in a particular mitigation feature, then survival of at least 80% of the installed mangroves is also required in addition to the typical success criteria indicated above.
 - Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- C. 3 years following completion of initial plantings (Year 6) –
 - Within each marsh feature, achieve a minimum average cover of 75%, comprised of native herbaceous species (includes planted species and volunteer species). Note that if black mangroves were initially planted in a particular mitigation feature, then survival of at least 50% of the installed mangroves is also required in addition to this typical vegetative cover success criterion.
- D. For the period beginning 4 years following completion of initial plantings and continuing through 20 years following completion of initial plantings (Years 7 through 27) –
 - Within each marsh feature, maintain a minimum average cover of 80%, comprised of native herbaceous species.

4. Invasive and Nuisance Vegetation

- A. Complete the initial eradication of invasive and nuisance plant species within 1 year of completion of final mitigation construction activities.

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- B. Maintain all marsh features such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total average vegetative cover accounted for by invasive and by nuisance species each constitutes less than 5% of the total average plant cover in each marsh feature during periods between maintenance events. These criteria must be satisfied throughout the duration of the overall monitoring period.

8. MITIGATION MONITORING AND REPORTING

8.1 STANDARD MITIGATION MONITORING AND MITIGATION MONITORING REPORTS

8.1.1 "Time Zero" Monitoring Report (Monitoring Report #1)

Shortly after completion of the final mitigation construction activities the mitigation features will be monitored and a "time zero" or "baseline" monitoring report prepared. Information provided will include the following items:

- A discussion of all mitigation activities completed.
- A description of the various mitigation features (the marsh restoration features).
- Plan view drawings of the mitigation features showing their approximate boundaries as well as significant interspersed features established within the marshes (as applicable), and the locations of permanent photo stations and staff gages installed.
- An as-built survey of finished grades in the mitigation features (topographic survey), along with an assessment of whether the applicable topography success criterion (criterion 2.A) has been satisfied and an assessment of whether the general construction success criteria (criteria 1.A and 1.B) have been satisfied. This survey will also contain survey information for any "gaps" or "fish dips" established in the perimeter containment dikes, as well as survey information for any rock dikes or armored earthen dikes. The as-built survey will be conducted using LiDAR supplemented by conventional ground-survey methods. Note that this survey would be performed prior to the initial planting of mitigation features and would be evaluated by the USACE prior to installing plants. If this evaluation indicates the topography success criterion has been achieved, then plants would be installed. However, if this evaluation indicates success has not been achieved, then supplemental topographic alterations would be performed by the USACE, a second as-built topographic survey of the affected areas would be conducted following completing of the supplemental topographic alterations, and plants would not be installed until the topography success criterion is achieved. Should this scenario arise, the time-zero monitoring report would not be submitted until the year plants are installed.
- Photographs documenting conditions in each restored marsh feature at the time of monitoring. Photos will be taken at permanent photo stations within the marsh features. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required as well as the locations of these stations will vary depending on the mitigation feature. The USACE will make this determination in coordination with the HET and NFS during the PED phase. At a minimum, there will be at least 4 photo stations established within each marsh feature.
- Water level elevation readings collected at the time of monitoring from staff gages installed within some of the restored marsh features. The number of staff gages and their locations will be determined by the USACE in coordination with the HET and NFS during the PED phase. The monitoring report will provide the staff gage data along with mean high and mean low water elevation data as gathered from a tidal elevation recording station in the general vicinity of the mitigation sites. The report will further address estimated mean high and mean low water elevations at the mitigation sites based on field indicators.

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- Various qualitative observations will be made in the mitigation features to help assess the status and success of mitigation and maintenance activities. These observations will include: general estimate of the average percent cover by native plant species; general estimates of the average percent cover by invasive and nuisance plant species; general observations concerning colonization of the mitigation features by volunteer native plant species; general condition of native vegetation; trends in the composition of the plant community; wildlife utilization as observed during monitoring (including fish species and other aquatic organisms); the condition of interspersed features (tidal channels, trenasses, depressions, etc.) constructed within the marsh features, noting any excessive scouring and/or siltation occurring within such features; the natural formation of interspersed features within restored marshes; observations regarding general surface water flow characteristics within marsh interspersed features; the general condition of “gaps”, “fish dips”, or similar features constructed in containment dikes; if present, the general condition of any armoring installed on permanent dikes. General observations made during the course of monitoring will also address potential problem zones and other factors deemed pertinent to the success of the mitigation program.
- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.
- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

8.1.2 Additional Monitoring Reports

All monitoring reports generated after the initial “time zero” report will provide the following information unless otherwise noted:

- A plan view drawing of the mitigation sites showing the approximate boundaries of the different mitigation features (marsh restoration features), monitoring transect locations, sampling plot locations, photo station locations, and staff gage locations.
- A brief description of maintenance and/or management and/or mitigation work performed since the previous monitoring report along with a discussion of any other significant occurrences.
- Photographs documenting conditions in the mitigation site at the time of monitoring. Photos will be taken at permanent photo stations within the mitigation site. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next.
- Quantitative data concerning plants in the ground cover stratum. Data will be collected from permanent sampling quadrats established at approximately equal intervals along permanent monitoring transects established within each marsh feature. Each sampling quadrat will be approximately 2 meters X 2 meters in size, although the dimensions of each quadrat may be increased if necessary to provide better data. The number of monitoring transects and number of sampling quadrats per transect will vary depending on the mitigation feature. This will be determined by the USACE in coordination with the HET and NFS during the PED phase. Data recorded from the sampling quadrats will include: average percent cover by native plant species; average percent cover by invasive plant species; average percent cover by nuisance plant species; composition of plant species and the wetland indicator status of each species. The average percent survival of planted species (i.e. number of living planted species as a percentage of total number of plants installed) will also be recorded. However, data for percent survival of planted species will only be recorded until such time as it is demonstrated that applicable success criteria for plant survivorship have been achieved.
- A summary of water level elevation data collected from the staff gages installed within the marsh restoration features as collected at the time of monitoring. Each monitoring report will also provide mean high and mean low water elevation data as gathered from a tidal elevation recording station in

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the general vicinity of the mitigation sites. The report will further address estimated mean high and mean low water elevations at the mitigation sites based on field indicators.

- Various qualitative observations will be made in the mitigation features to help assess the status and success of mitigation and maintenance activities. These observations will include: general estimate of the average percent cover by native plant species; general estimates of the average percent cover by invasive and nuisance plant species; general observations concerning colonization of the mitigation features by volunteer native plant species; general condition of native vegetation; trends in the composition of the plant community; wildlife utilization as observed during monitoring (including fish species and other aquatic organisms); the condition of interspersed features constructed within the marsh features, noting any excessive scouring and/or siltation occurring within such features; the natural formation of interspersed features within restored marshes; observations regarding general surface water flow characteristics within marsh interspersed features; the general condition of “gaps”, “fish dips”, or similar features constructed in containment dikes; if present, the general condition of any armoring installed on permanent dikes. General observations made during the course of monitoring will also address potential problem zones and other factors deemed pertinent to the success of the mitigation program.
- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.
- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.
- For monitoring report #2 only, a detailed inventory of all species planted in each mitigation feature, including the number of each species planted and the stock size planted.
- For any monitoring report conducted in a year when one or more marsh restoration features must be re-planted, a detailed inventory of all species installed in the applicable mitigation feature(s), including the number of each species planted and the stock size planted. A depiction of the areas re-planted will also be provided.
- For monitoring report #2 and monitoring report #5, a survey of surface grades in the mitigation features (topographic survey), along with an assessment of whether the applicable topography success criteria have been satisfied (e.g. success criterion 2.B for monitoring report #2, success criterion 2.C for monitoring report #5). These surveys will be conducted using LiDAR supplemented by conventional ground-survey methods. A given survey indicates topographic success criteria have not been achieved and supplemental topographic alterations are necessary, then another topographic survey may be required following completion of the supplemental alterations. This determination will be made by USACE in coordination with the HET and NFS.

8.2 DISTRICT CONSULTATION REPORTS & USACE CIVIL WORKS PROJECT MITIGATION DATABASE REPORTS

Section 2036(a) of WRDA 2007 requires the USACE to conduct annual consultation with appropriate Federal and State agencies to assess the success of mitigation plans and to prepare annual reports summarizing the results of the consultations. To satisfy these requirements, annual consultation reports (District Consultation Reports) will be prepared and submitted to the USACE Mississippi Valley Division (MVD), or the reports will be submitted as directed by MVD. Each report will provide the following information:

- List of the types of mitigation implemented.
- Brief description of the mitigation, including acres implemented and acres remaining to be implemented (if any).
- Description of the consultation process (steps taken to consult with other Federal agencies and State agencies).
- Discussion of the status of consultation, identifying the agencies involved and the outcome. If consultation is complete, a listing of the outcome as one of the following: no action needed; no response from Federal or state agencies on consultation; on schedule with no adaptive management

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implemented due to consultation, or on schedule with adaptive management implemented due to consultation; behind schedule with adaptive management implemented due to consultation, or; behind schedule for reasons not related to consultation.

- Discussion of the outcome of consultation (if completed). This discussion will include: an assessment of the likelihood that the mitigation will achieve the success criteria specified in the mitigation plan (copy of plan provided); the projected timeline for achieving mitigation success, and; any recommendations for improving the likelihood of success.

In addition to the District Consultation Reports discussed above, data and information concerning the mitigation will be entered into the USACE's Civil Works Project Mitigation Database on an annual basis. The data and information required for entry into this database are specified within the database itself (website URL: <https://sam-db01.mob.sam.ds.usace.army.mil:4443/pls/apex/f?p=107>).

8.3 MITIGATION MONITORING & REPORTING SCHEDULE AND RESPONSIBILITIES: STANDARD MONITORING AND REPORTING

Monitoring will typically take place in late summer of the year of monitoring, but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring reports will be submitted by November 30 of each year of monitoring. Monitoring reports will be provided to the USACE, the NFS, and the agencies comprising the HET.

The USACE will be responsible for conducting the monitoring events and preparing the associated monitoring reports until such time that the following mitigation success criteria are achieved (criteria follow numbering system used in success criteria section):

1. General Construction – A and B (e.g. criteria 1.A and 1.B).
2. Topography – A and B (e.g. criteria 2.A and 2.B).
3. Native Vegetation – A and B (e.g. criteria 3.A and 3.B).
4. Invasive & Nuisance Vegetation – A (e.g. criterion 4.A), plus B (e.g. criterion 4.B) until such time as project is transferred to the NFS.

Monitoring events associated with the above will include the “time zero” (first or baseline) monitoring event plus annual monitoring events thereafter until the mitigation project is transferred to the NFS. Unless otherwise indicated herein, the NFS will be responsible for conducting the required monitoring events and preparing the associated monitoring reports after the USACE has demonstrated the mitigation success criteria listed above have been achieved.

Once monitoring responsibilities have been transferred to the NFS, the next monitoring event will typically take place during the year that attainment of success criterion 2.C (topography criterion applicable 3 years after completion of final mitigation construction activities) must be demonstrated, and the immediately subsequent monitoring event will typically take place during the year that attainment of success criterion 3.C (native vegetation criterion applicable 3 years after completion of initial plantings) must be demonstrated. Thereafter, monitoring will typically be conducted every 5 years until success criterion 3.D (native vegetation criterion applicable 4 years through 20 years following completion of initial marsh plantings) is fully satisfied.

If certain success criteria are not achieved, failure to attain these criteria would trigger the need for additional monitoring events not addressed in the preceding paragraphs. The USACE would be responsible for conducting such additional monitoring and preparing the associated monitoring reports under the following circumstances:

- (A) If the initial survival criterion for planted species or the initial vegetative cover criterion are not achieved (i.e. the criteria specified in native vegetation success criterion 3.B), a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable survival criterion or vegetative cover criteria have been satisfied (e.g. that corrective actions were successful). The USACE would also be responsible for the purchase and installation of supplemental plants needed to attain the success criteria.

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- (B) If topographic success criteria 2.A or 2.B are not achieved, a monitoring report will be required for each consecutive year until two sequential annual reports indicate the applicable criteria have been satisfied. Since failure to meet topographic success criteria would mandate corrective actions such as addition of fill, removal of fill, or other actions to change grades within the subject marsh feature, the USACE would also be responsible for performing the necessary corrective actions.

There could also be cases where failure to attain certain success criteria would trigger the need for additional monitoring events for which the NFS would be responsible. The NFS would be responsible for conducting such additional monitoring and preparing the associated monitoring reports under the following circumstances:

- (A) If the vegetative cover criterion specified for 3 years after the initial planting of marsh features is not achieved (e.g. native vegetation success criterion 3.C), a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the vegetative cover criterion has been satisfied. The NFS would also be responsible for the purchase and installation of supplemental plants needed to attain the success criterion.
- (B) If the topographic success criterion 2.C is not achieved, a monitoring report will be required for each consecutive year until two sequential annual reports indicate success criterion has been satisfied. Since failure to meet this topographic success criterion would mandate corrective actions such as addition of fill, removal of fill, or other actions to change grades within the subject marsh feature, the NFS would also be responsible for performing the necessary corrective actions.
- (C) Native vegetation success criterion 3.D is applicable to the period extending from 4 years through 20 years following completion of the initial marsh plantings and is applicable to all marsh features. If this criterion is not satisfied at the time of monitoring, the NFS would be responsible for implementing corrective actions. Such actions could include installing additional plants in the subject marsh (probable course of action), adding sediment to the subject marsh in problem zones (marsh nourishment), or a combination of these activities. Under this scenario, a monitoring report will be required for each consecutive year following completion of the corrective actions until two sequential annual reports indicate that the vegetative cover criterion has been attained. The NFS would be responsible for conducting these additional monitoring events and preparing the associated monitoring reports.
- (D) Various unforeseen circumstances besides those above could severely threaten mitigation success. If one or more NFS monitoring reports called for in Table K-7 indicate mitigation success is severely threatened, as determined by the USACE in coordination with the HET and the NFS, then significant corrective actions (adaptive management) would be necessary. The need for such actions could trigger the need for additional monitoring/reporting events not listed in Table K-7, including the need to extend monitoring beyond the time period indicated in said table. The NFS would be responsible for conducting these additional monitoring events, preparing the associated monitoring reports, and conducting the required corrective actions. Necessary corrective actions would be determined by the USACE in coordination with the HET and NFS.

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The following table indicates the currently anticipated monitoring report schedule and the party responsible for conducting the monitoring and preparing the report.

Table K-7. Standard mitigation monitoring report schedule and monitoring responsibility.

Year	Monitoring Report Number	Party Responsible for Monitoring and Reporting
1 (begin & complete initial construction activities; completion near end of year)	N/A	N/A
2 (begin & complete final construction activities; filled areas settle to final target grades near end of year)	1 (Time Zero Report)	USACE
3 (complete initial plantings early in year; complete initial invasive/nuisance plant eradication)	2	USACE
4 (1 year after initial plantings; 2 years after completion of final construction activities)	3	USACE
5 (Re-planting if necessary; 3 years after completion of final construction activities)	4	USACE if replanting necessary; NFS if replanting not necessary
6 (1 year after re-planting if re-planting needed)	5A*	USACE if replanting necessary in year 5. No report needed if replanting not necessary in year 5.
7 (2 years after re-planting if re-planting needed; 5 years after initial plantings)	5B	USACE if replanting necessary in year 5; NFS if replanting not necessary in year 5
12	6	NFS
17	7	NFS
22	8	NFS
27	9	NFS
32	10	NFS

It is noted that monitoring report 5A indicated in the preceding table will only be necessary if the third monitoring report indicates that native vegetation success criterion #3.B pertaining to the survival of planted species/percent cover by native plant species has not been achieved, thereby requiring re-planting in Year #5. If re-planting is unnecessary, there would be no monitoring in year 6. However, it has been assumed that some re-planting will be necessary. The schedule provided in the table does not account for the need to physically adjust topography in the mitigation features once final construction activities have been completed. Should such adjustments be necessary to achieve applicable topographic success criteria, then the monitoring schedule presented would likely require adjustments. The schedule provided also does not account for other unforeseen circumstances that may severely threaten mitigation success. Such circumstances would likely require corrective actions and could also require adjustments to the monitoring schedule, including extending the overall monitoring period.

Although the USACE will be responsible for conducting the monitoring necessary for monitoring reports 1 through 4 (as well as reports 5A and 5B if re-planting is necessary in year 5) and will be responsible for preparing these reports, the costs for these activities will be cost-shared with the NFS. The costs associated with conducting the monitoring and preparing all monitoring reports following report 5B will be solely borne by

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the NFS. The same is true for conducting the monitoring and preparing the report called for in year 7 (report 5B) if no re-planting is required in year 5.

It is not feasible at this time to accurately estimate the actual calendar year when mitigation construction activities will be initiated. This explains why the years indicated in the preceding table are not actual calendar years. The mitigation construction schedule will be determined during the PED phase.

Once monitoring responsibilities have transferred to the NFS, the NFS will retain the ability to modify the monitoring plan and the monitoring schedule should this become necessary due to unforeseen events or to improve the information provided through monitoring. Fifteen years following completion of initial plantings, the number of monitoring plots and/or monitoring transects that must be sampled during monitoring events may be reduced if it is clear that mitigation success is proceeding as anticipated. Any significant modifications to the monitoring plan or the monitoring schedule must first be approved by the USACE in coordination with the HET and NFS.

8.4 MITIGATION MONITORING & REPORTING SCHEDULE AND RESPONSIBILITIES: DISTRICT CONSULTATION REPORTS AND USACE CIVIL WORKS PROJECT MITIGATION DATABASE REPORTS

The USACE will be responsible for preparing and submitting all District Consultation Reports. These reports will be submitted on annual basis beginning in the year the mitigation plan is implemented (i.e. start of mitigation construction) and continuing throughout the life of the mitigation monitoring period addressed in Section 8.3. The date for submittal of each report will be in accordance with guidance provided by MVD and/or HQUSACE (USACE Headquarters). Presently, MVD guidance is each annual report must be submitted at least 14 working days prior to October 1st each year; however, this guidance is subject to change.

The agencies involved in the consultation process will include, at a minimum: USACE, Mississippi Valley Division, New Orleans District (CEMVN); the Non-Federal Sponsor; US Fish and Wildlife Service (USFWS); National Marine Fisheries Service (NMFS); Louisiana Department of Wildlife and Fisheries (LDWF); Louisiana Department of Natural Resources (LDNR). The USACE will be responsible for conducting the consultation until the mitigation project is transferred to the Non-Federal Sponsor. Thereafter, the Non-Federal Sponsor will be responsible for conducting the consultation and for providing results of the consultation to USACE (i.e. Non-Federal Sponsor will be responsible for obtaining and providing to USACE all information necessary for preparing the District Consultation Report).

The USACE will be responsible for inputting all information required for the USACE's Civil Works Mitigation Project Database as regards this mitigation project. This information will be input by CEMVN on an annual basis beginning in the year the mitigation is implemented and continuing throughout the monitoring period addressed in Section 8.3. The information will be input by the deadline(s) established by HQUSACE. The USACE will be responsible for gathering the information necessary for database input until the mitigation monitoring responsibilities are transferred to the Non-Federal Sponsor. Thereafter, the Non-Federal Sponsor will be responsible for gathering this information and providing it to CEMVN for input.

8.5 COST OF MITIGATION MONITORING AND REPORTING

The total cost of mitigation monitoring and reporting activities addressed herein is currently estimated to be approximately \$7,660,800. This estimate includes all mitigation monitoring and reporting costs throughout the monitoring period addressed in Section 8.3. This estimate also includes the cost of conducting the additional monitoring required due to the need for one re-planting event following the initial planting event. It was assumed that one re-planting event would be necessary to meet the initial survival/cover success criteria for planted native vegetation. If this assumption is erroneous, the estimated monitoring and reporting cost would decrease. This cost estimate does not account for any further topographic alterations following completion of the final mitigation construction activities since it is not anticipated that such physical alterations will be necessary. If this assumption is violated, the estimated mitigation monitoring and reporting cost would increase due to the need for additional monitoring/reporting events. Note that this cost estimate

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also does not include additional monitoring and reporting costs that would be incurred should the adaptive management plan need to be implemented.

9. FINANCIAL ASSURANCES

Financial assurances are required to ensure that the compensatory mitigation project would be successful. In this case the Project Partnership Agreement (PPA) between the Non-Federal Sponsor and the Federal Government provides the required financial assurance for this mitigation project. In the event that the Non-Federal Sponsor fails to perform, the CEMVN has the right to complete, operate, maintain, repair, rehabilitate or replace any project feature, including mitigation features, but such action would not relieve the Non-Federal Sponsor of its responsibility to meet its obligations and would not preclude the US from pursuing any remedy at law or equity to ensure the Non-Federal Sponsor's performance.

10. DEFINITION OF TERMS

Certain terms used herein shall have the meaning discussed in the following subsections.

Habitat Evaluation Team (HET)

This interagency team consists of various staff from the following resource agencies: USACE, U.S. Fish and Wildlife Service (USFWS, or FWS), U.S. Environmental Protection Agency (EPA), U.S. Geological Survey (USGS), Natural Resources Conservation Service (NRCS), Louisiana Coastal Protection and Restoration Authority (CPRA), Louisiana Department of Wildlife and Fisheries (LDWF), and Louisiana Department of Natural Resources (LDNR).

Non-Federal Sponsor (NFS)

This term refers to the Non-Federal Sponsor for the project. The Louisiana Coastal Protection and Restoration Authority Board (CPRAB) and the Terrebonne Levee and Conservation District (TLCD) intend to be the non-Federal co-sponsors for the project. Despite there really being two non-Federal sponsors in this case, the singular term "Non-Federal Sponsor" (NFS) is used herein to refer to the two co-sponsors.

Invasive Plant Species

All plant species identified as invasive or as non-indigenous (exotic) in the following two sources:

Louisiana Aquatic Invasive Species Task Force. 2005. State Management Plan for Aquatic Invasive Species in Louisiana, Appendix B. Invasive Species in Louisiana (plants). Center for Bioenvironmental Research, Tulane & Xavier Universities, New Orleans, LA.
(Website - http://is.cbr.tulane.edu/docs_IS/LAISMP7.pdf)

Barataria-Terrebonne National Estuary Program (BTNEP). 2012. Exotic Invasive Species of the Barataria-Terrebonne, Invasive Species in Louisiana. BTNEP, Thibodaux, LA. (Website - <http://invasive.btneep.org/invasivesvsnatives/invasivesinla2list.aspx>)

In addition, invasive plant species include; Japanese climbing fern (*Lygodium japonicum*), tall fescue (*Festuca arundinacea*), chinaberry (*Miscanthus sinensis*), Brazilian vervain (*Verbena litoralis* var. *brevibracteata*), coral ardisia (*Ardisia crenata*), Japanese ardisia (*Ardisia japonica*), cogon grass (*Imperata cylindrical*), golden bamboo (*Phyllostachys aurea*), and rescuegrass (*Bromus catharticus*).

Nuisance Plant Species

Nuisance plant species will include native species deemed detrimental due to their potential adverse competition with desirable native species. Nuisance plant species identified for the mitigation project include; dog-fennel (*Eupatorium* spp.), ragweed (*Ambrosia* spp.), cattail (*Typha* spp.), grapevine (*Vitis* spp.), wild balsam apple (*Momordica charantia*), climbing hempvine (*Mikania scandens*, *M. micrantha*), pepper vine (*Ampelopsis arborea*), common reed (*Phragmites australis*), catbrier (*Smilax* spp.), blackberry (*Rubus* spp.), black willow (*Salix nigra*), and box elder (*Acer negundo*). Following completion of the initial mitigation

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activities (e.g. placement of fill, initial plantings), the preceding list may be expanded to include other nuisance plant species. Any such addition to the list would be based on the results of the standard monitoring reports. The determination of whether a particular new plant species should be considered as a nuisance species and therefore eradicated or controlled would be determined by the USACE in coordination with the Non-Federal Sponsor and Interagency Team.

Native Plant Species

This category includes all plant species that are not classified as invasive plant species and are not considered to be nuisance plant species.

USACE Hydrophytic Vegetation Criteria

Reference to satisfaction of USACE hydrophytic vegetation criteria (i.e. plant community is dominated by hydrophytic vegetation) shall mean that sampling of the plant community demonstrates that one or more of the hydrophytic vegetation indicators set forth in the following reference is achieved:

USACE. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0); ERDC/EL TR-10-20. USACE Engineer Research and Development Center, Vicksburg, MS.

Wetland Indicator Status of Plant Species

The wetland indicator status of plants is a means of classifying the estimated probability of a species occurring in wetlands versus non-wetlands. Indicator categories include; obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), and obligate upland (UPL). The wetland indicator status of a particular plant species shall be as it is set forth in the following reference (the "2012 National Wetland Plant List") using the Region 2 listing contained therein. However, if the USACE approves and adopts a new list in the future, then the currently approved list will apply.

Lichvar, Robert W. and J.T. Kartesz. 2009. North American Digital Flora: National Wetland Plant List, version 2.4.0 (https://wetland_plants.usace.army.mil). USACE, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, NH and BONAP, Chapel Hill, NC.

Growing Season

As used herein, the growing season is considered to be the period from April through October of any given year, although some deviation from this typical range is allowed.

Interspersion Features

This term refers to shallow open water features situated within marsh habitats. Examples include tidal channels, creeks, trenasses, and relatively small, isolated ponds. Emergent vegetation is typically absent in such features although they may contain submerged aquatic vegetation. They provide areas of foraging and nursery habitat for fish and shellfish along with associated predators, and provide loafing areas for waterfowl and other waterbirds. The marsh/open water interface forms an ecotone where post-larval and juvenile organisms can find cover and where prey species frequently concentrate.



Figure K1. Overview of all proposed mitigation features.



Figure K2. Proposed mitigation features: Intermediate marsh restoration features IM1 (862 ac.), IM2 (293 ac.), IM3 (213 ac.), and IM4 (134 ac.).

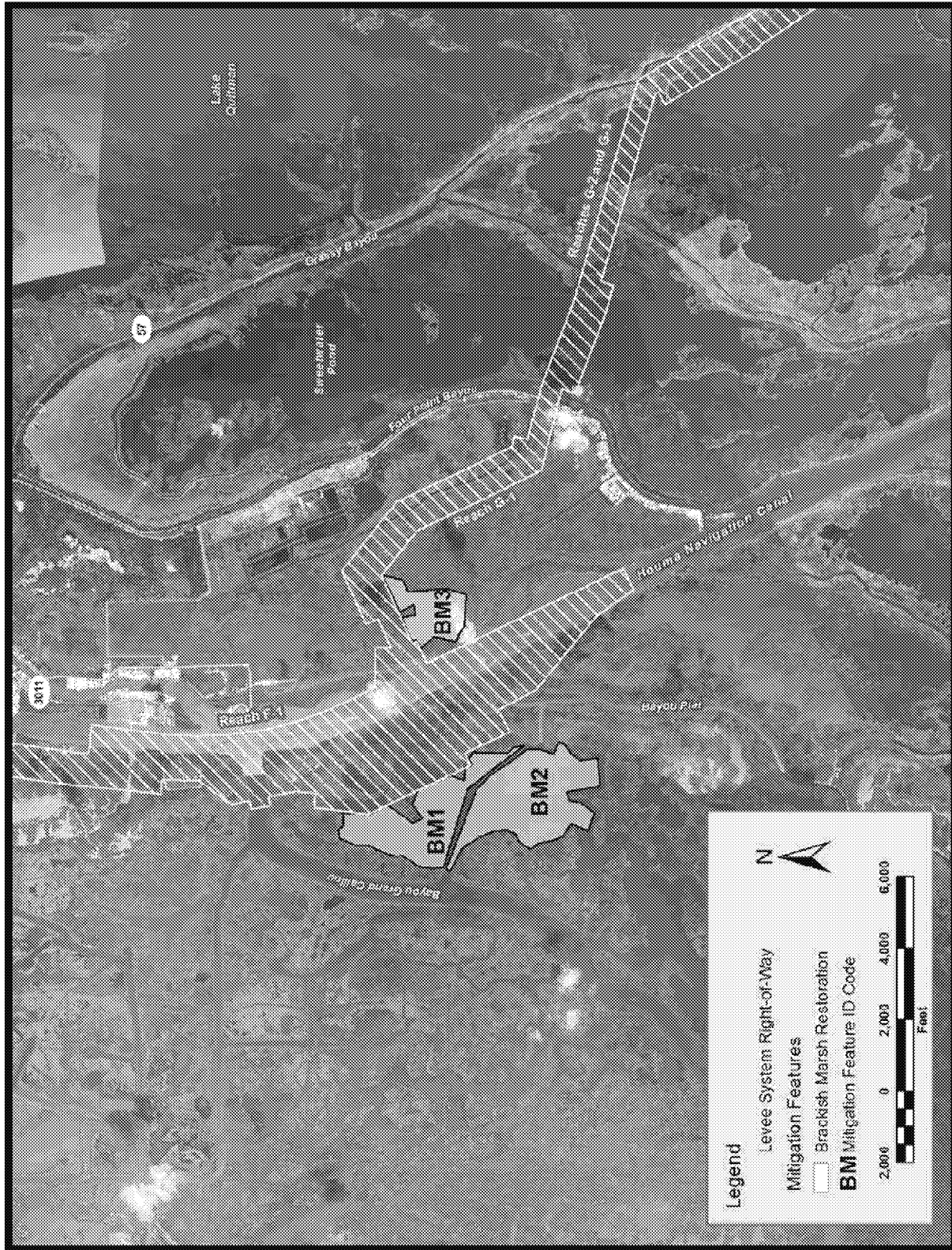


Figure K3. Proposed mitigation features: Brackish marsh restoration features BM1 (129 ac.), BM2 (170 ac.), And BM3 (59 ac.).

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